

CLAIMS

WHAT IS CLAIMED IS:

1. A BGA package, comprising:
 - 2 a thick film ceramic substrate, having a first side and a second side;
 - 4 a laser cut die cavity within the ceramic substrate, permitting short wire bond attachment of pads on an IC die to pads on the first side of the ceramic substrate and direct attachment of an IC die to a heat spreader on the second side of the substrate through the laser cut die cavity; and
 - 6 one or more passive components mounted on the first side of the
 - 8 substrate.
2. The BGA package in accordance with claim 1, wherein the thick
2 film ceramic substrate comprises alumina.
3. The BGA package in accordance with claim 1, wherein the one or
2 more passive components comprises one or more laser trimmed integrated substrate resistors.
4. The BGA package in accordance with claim 1, wherein the one or
2 more passive components comprises one or more integrated substrate capacitors.
5. The BGA package in accordance with claim 1, wherein the one or
2 more passive components comprises one or more integrated substrate inductors.

2 6. The BGA package in accordance with claim 1, further
 comprising at least one discrete component mounted on the
 first side of the ceramic substrate.

2 7. The BGA package in accordance with claim 6, wherein the at least
 one discrete component comprises at least one IC.

2 8. The BGA package in accordance with claim 6, wherein the at least
 one discrete component comprises at least one active component.

2 9. The BGA package in accordance with claim 1, wherein the overall
 package thickness is less than approximately 1.8mm.

2 10. A BGA package comprising:

4 a thick film ceramic substrate having a first side and a second
 side with a laser cut die cavity extending from the first side to the
 second side of the substrate;

8 one or more pads on the first side of the substrate on the
 perimeter of the laser cut die cavity;

10 one or more integrated passive components on the first side of
 the substrate;

12 a heat spreader on the second side of the substrate;

14 an IC die attached to the heat spreader via the laser cut IC die
 cavity, wherein the IC die has one or more pads exposed to the first side of
16 the substrate via the laser cut die cavity; and

18 one or more wire bonds between one or more pads on the IC
 die and one or more pads on the first side of the substrate.

2 11. The BGA package according to claim 10, wherein the thick film ceramic substrate comprises alumina.

2 12. The BGA package according to claim 10, wherein the one or more passive components comprises one or more laser trimmed integrated substrate resistors.

2 13. The BGA package in accordance with claim 10, wherein the one or more passive components comprises one or more integrated substrate capacitors.

2 14. The BGA package in accordance with claim 10, wherein the one or more passive components comprises one or more integrated substrate inductors.

2 15. The BGA package in accordance with claim 10, wherein the at least one discrete component comprises at least one IC.

2 16. The BGA package in accordance with claim 10, wherein the at least one discrete component comprises at least one active component.

2 17. The BGA package in accordance with claim 10, wherein the overall package thickness is less than approximately 1.8mm.

2 18. A method for manufacturing a BGA package, comprising:
forming a thick film ceramic substrate with a first side and a second side;
4 forming one or more integrated passive components on the first side of the substrate;

- 6 mounting one or more discrete components on the first side of the
substrate;
- 8 forming transmissions lines on the first side of the substrate;
laser cutting a die cavity in the substrate;
- 10 attaching a heat spreader to the second side of the substrate;
attaching an IC die to the heat spreader via the die cavity;
- 12 forming wire bonds between pads on the IC die and pads on the first
surface of the substrate.

19. The method in accordance with claim 18, further comprising:
- 2 attaching one or more discrete components to the first side of the
substrate.

20. The method in accordance with claim 19, where in the step of
- 2 attaching one or more discrete components comprises attaching one or
more active components.

- 21 The method in accordance with 19, wherein the step of attaching
- 2 one or more discrete components comprises attaching one or more ICs.